the recycling company ALBA Group

# resources SAVED by recycling.

**The circular economy paves the way to a sustainable future: In 2017, ALBA Group's recycling activities saved around 30.2 million tonnes of primary resources and some 4.1 million tonnes of greenhouse gases.***

resources SAVED®

*Source: Fraunhofer UMSICHT

**ALBA Group**

ALBA Group operates within Germany, Europe and Asia. In 2017, the Group's divisions generated a turnover of around 1.8 billion euros and employed a total of around 7,500 people. This makes ALBA Group one of the leading recycling and environmental services providers and raw material suppliers worldwide.

**Fraunhofer UMSICHT**

Fraunhofer UMSICHT is a pioneer of sustainable energy and raw materials management, providing scientific results and transferring them to businesses, society and politics. Working together with partners, the dedicated team researches and develops sustainable products, processes and services that inspire. We want our developments to be economically successful, socially equitable and sustainable. The balance between these objectives is always at the forefront of our thinking. Based in Oberhausen, Willich and Sulzbach-Rosenberg in Germany, the institute in 2017 generated a turnover of more than 41.6 million euros with a staff of 450 persons. As one of 72 institutes and research units of the Fraunhofer-Gesellschaft, the leading organisation for applied research in Europe, we are a worldwide network and promote international collaborations.

Dear Readers,

We need to talk about plastics – not just because the amount of plastic in the world's oceans is reaching dramatic proportions and the European Union adopted its first joint plastics strategy in early 2018. We need to talk about plastics because we will not be able to get by without this high-tech material in the foreseeable future. And because we already have technologies that can ensure the sustainable management of the plastics currently in circulation. German Chancellor Angela Merkel said during a government Q&A at the Bundestag this year: 'I am committed to reducing the use of plastics. Germany can and should lead by example here, although we have already made a great contribution through our recycling mechanisms.'

Closed-cycle management is the order of the day because the age of plastic downcycling is over. We closed the material loop for plastics several years ago with Interseroh, a subsidiary of the ALBA Group. We achieved this with the help of our Recycled-Resource process, which our scientists are continually developing in our own competence centre in Maribor. New options are available to the industry as well. Last year Interseroh began offering its 'Made for Recycling' service to manufacturers, a scientifically sound method for making packaging more recycling-friendly.

To put it plainly: high-quality plastics recycling conserves natural resources, reduces greenhouse gas emissions and – assuming that a functioning collection system is in place – can effectively curb the amount of waste entering the environment. This year's 'resources SAVED by recycling' study, which the Fraunhofer Institute UMSICHT carried out for us for the eleventh time, impressively confirms this. At the start of this brochure, we explain how the scientists approach their study using the example of the plastics material flow.

The global community is currently consuming the resources of around 1.7 earths per year. This cannot continue. Let's send a signal and take full advantage of the opportunities offered by environmental technologies for protecting resources, the climate and the environment. The potential promised by closed-cycle management is explained in this brochure.

We hope you enjoy reading it.
Sincerely,

Dr Axel Schweitzer  Dr Eric Schweitzer
Chairmen of ALBA Group plc & Co. KG

# **Recycling vs. primary production –** focus on plastics

Technically sound recycling improves our ecological footprint, reduces our impact on the environment and protects the climate. This applies not only to ‘classic’ materials such as metals, wood, paper and glass, but also to waste electrical equipment and plastics. The scientific proof of this is provided by the ‘resources SAVED by recycling’ study, which the Fraunhofer Institute for Environmental, Safety and Energy Technology UMSICHT carries out each year for the ALBA Group.

What makes this study special is the methodology used. This methodology allows us to compare the resource consumption and greenhouse gas emissions of primary production with the impact of processing in the ALBA Group – down to the kilogramme. First the Fraunhofer experts determine the quantity of resources and climate-damaging gases that are consumed or released in primary production. Then they investigate the resource consumption and greenhouse gas emissions of the closed-cycle management processes in the Group. The difference between these two calculations reveals the positive environmental effects for each material flow. Which production steps have the biggest environmental impact can be seen in the example of a fruit tray made of plastic – or, more precisely, of polypropylene.

**Primary production: risks and side effects**

In the primary production of plastics, most energy and resources are consumed in the extraction of petroleum, the basic raw material for polypropylene. Worldwide petroleum production currently amounts to around 4.4 billion tonnes – and this number is growing. The lion’s share is produced by the Arabian Peninsula, the USA, Russia, Canada and China. In order to pump petroleum to the earth’s surface, it is necessary to drill through deep layers of rock, either onshore (on land) or offshore (on high seas). This energy-intensive process also poses risks to the environment because oil wells can catch fire, or oil can leak uncontrollably into the sea. Extracted oil is transported via pipelines or tankers to refineries, where it undergoes distillation, a thermal separation process that isolates the individual components of the crude oil. The subsequent polymerisation process produces different types of plastic, including polypropylene – the second most frequently used plastic in the world, accounting for around 20 per cent of total global production. In 2015 alone, an estimated 380 million tonnes of plastics were produced globally. And this amount is also expected to grow further.

The primary production of one tonne of polypropylene consumes around 5.2 tonnes of raw materials and results in around 1.7 tonnes of greenhouse gas emissions.

**The recycling process: more sustainable without an upstream chain**

The recycling process for plastics proves that it doesn’t have to be this way. Products already in circulation are the basic material here. This eliminates the need for the energy-intensive processes of drilling, extracting and refining crude oil. In Germany, plastic packaging like the polypropylene fruit tray is collected with other lightweight household packaging (in what is known as the Yellow Bag, Yellow Bin or recycling bin), so most of it does not wind up in the environment. After collection, the waste is taken to sorting plants, where the individual plastic types and materials are separated as completely

Drilling, pumping, extraction: drawing oil from deep layers of rock is an energy- and resource-intensive process.

as possible – the prerequisite for optimum material recycling.
Interseroh developed its multi-award-winning Recycled-Resource process to supply the industry with high-quality recycled plastics. This completely closes the recyclable loop for plastics. One of the upcycling products resulting from this process is the recycled plastic known as Procyclen, which has the quality of a new material.
The closed-loop circulation of plastics also consumes resources and energy, but it requires much less than primary production.

The environmentally friendly production of one tonne of polypropylene within the ALBA Group consumes an average of 224 kilograms of resources and results in 966 kilograms of greenhouse gas emissions.

Innovation, research and development are making recycling increasingly efficient. Furthermore, processing used plastics protects natural habitats and eliminates the need for risky pipelines to transport crude oil.

**About 'resources SAVED by recycling'**

This study analyses the quantity of greenhouse gases and biotic (renewable) and abiotic (non-renewable) resources that are conserved through recycling in the ALBA Group as compared to primary production. For 2017, Fraunhofer UMSICHT researched the following material flows: plastics, metals, waste electrical equipment, wood, paper/paperboard/cardboard and glass.

**The overall findings:**
In 2017, the ALBA Group managed around 4.8 million tonnes of recyclables in a closed loop. The recycling specialist thus avoided the extraction, transport and processing of a total of

**30.2 million** **tonnes of primary resources**

At the same time, the ALBA Group saved

**4.1 million** **tonnes of greenhouse gas emissions**

Some 409,700 hectares of mixed woodland would be needed to capture this volume of greenhouse gases. This would be the size of the Ruhr Valley.

**Each of the following chapters looks at an exemplary recycling process in the ALBA Group. These examples show that the material flows are being managed in a loop by experts – not just in theory, but in practice every single day.**

The overall report findings aggregate data from ALBA Group recycling activities in Austria, Germany, Poland and Slovenia. The individual quantities mentioned in the brochure relate solely to material flows in Germany. This is due to the country-specific collection and recycling practices for individual materials.

# A project with **great appeal**

Dr Markus Hiebel, Head of the Sustainability and Resources Management Department at the Fraunhofer Institute for Environmental, Safety and Energy Technology UMSICHT, talks about the challenge of generating a robust life-cycle analysis for an international recycling company.

**Dr Hiebel, each year you calculate the resources and greenhouse gases saved through the recycling activities in the ALBA Group. What makes your life-cycle analysis methodology special?**

More and more people, organisations and companies want to know which products and processes really offer ecological benefits. Our job is to answer these questions in a scientifically sound way – and our method of choice is the ISO 14040/44 life-cycle analysis standard, which is an internationally recognised tool.
Eleven years ago the ALBA Group decided to work with us to make it possible to measure the environmental effects of recycling and raise public awareness of this. We therefore developed a series of studies, now known as 'resources SAVED by recycling', and applied this life-cycle analysis to the recycling flows of the ALBA Group.

**The study compares the environmental effects of recycling with those of primary production. What's the biggest challenge with this analysis?**

We can only measure this climate and resource 'baggage' if the underlying data is correct. This is always a big challenge, because the primary production of materials raises numerous questions: How much rock is excavated when copper ore is mined, and how much woodland is cleared? Which processes are used to recycle plastics? Which sources of energy are used to produce the electricity needed to run the equipment? How much fuel is consumed when transporting the raw materials, and which modes of transport are used to handle the logistics?
Then there are geopolitical aspects: In which countries does the most copper mining or oil refinery take place? Is there a particularly strong player in the market right now, and are the import shares of each country shifting? To ensure a robust comparison, we also need to keep the data time periods in mind. Many products only enter the recycling loop several years after being produced. For example, the copper being recycled now was probably mined as a primary material more than ten years ago – but it is replacing copper that would otherwise have to be painstakingly extracted today.

**Where do you find this complex life-cycle analysis data?**

The information on primary production mostly comes from the Life Cycle Assessment database, known as GaBi for short, which is continually updated. You can think of it as a giant library full of data sets: weights, delivery routes, means of transport, energy consumption and much more, all of which relates to different raw materials and storage facilities. There are more than 20 datasets in the system for copper, for example.
We put our expertise to use here so we can select the exact information that applies to the material flows of the ALBA Group. We call this 'modelling'.

**Who makes up the 'Think Tank' at Fraunhofer UMSICHT that works on the study each year?**

Our four-member core team comprises an expert for life-cycle analysis, a geoscientist, a chemical engineer and a sustainability management specialist. This broad knowledge base is critical to the success of the study. The ALBA Group helps to manage a wide variety of materials in a closed loop, and our job is to model the recycling processes for each material as precisely as possible.
If we encounter a process engineering question that the team can't answer, we fall back on the know-how in our Institute. More than 360 people work at our Oberhausen site, some of them in a plastics technical centre where we develop our own processes and formulations. We take advantage of this expertise when we have unanswered questions about plastics processing, for example.

**And how do you get the data for the processing methods in the ALBA Group?**

Above all, we have to work closely with the individual specialist departments. After a kick-off discussion, we send questionnaires to each of our contacts, who gather all of the data according to our specifications and send it to us – everything from current recycling quantities and the energy consumption of the facilities, to transport distances and export shares.

**After eleven years, is the 'resources SAVED by recycling' study still an exciting project for you?**

In general, the ecological baggage of recycling materials grows lighter the more low-emission and energy-efficient the processing technology is. This is why high-quality closed-cycle management based on modern standards is critical to a positive life-cycle analysis.

Absolutely. On the one hand, the ALBA Group is always introducing process innovations that we have to take into account in our analyses. And on the other hand, we are continually developing our study methodology together with the ALBA Group. Starting in 2013, for example, we not only reported greenhouse gas emissions but also, for the first time, the resources saved through recycling – a unique concept in the industry. This is another reason why 'resources SAVED by recycling' is a project with great appeal.

Since our first study was published for the ALBA Group, many other companies have developed their own life-cycle analyses and shared their findings with their customers. This is slowly but surely changing perceptions in society. More and more consumers are deliberately choosing products made of recycled materials because they know how effective our environmental technologies are in Germany and how much a circular economy benefits the environment. Our study is helping to pave the way for more sustainable business and consumption.

Dr. Markus Hiebel has enjoyed producing (resource) analyses for ALBA Group for 11 years.

# **Upcycling –** leading by example

Consumer electronics, packaging, mobility: the variety of uses for plastics is matched only by the challenge of recycling them homogeneously, with no loss of quality. Interseroh has closed this loop – and established its own competence centre for recycled plastics in Slovenia, where the course is being set for the future of this material flow.

What do recycled plastics need to be made of so they can fully replace primary materials in industry? Dr Manica Ulcnik-Krump is looking for answers to this question. She is a chemist who leads the competence centre for recycling plastics opened by Interseroh in Maribor, Slovenia, in September 2016. In this modern, open building complex, her team is developing ideas for new recycling formulations, conducting element and washing analyses, and working on the colouration of regranulate – the recycled plastic pellets created using waste from the Yellow Bin and Yellow Bag, among other things.

**Growing demand for plastics**

The chemical modification of plastics is Manica Ulcnik-Krump's area of expertise and long-standing passion. Modification is necessary because this high-performance material must meet a variety of demands. Plastic is the material of choice for food packaging, it makes aircrafts lighter, tablets more robust and buildings better insulated. As a result, the production of mass plastics such as polyethylene, polypropylene, polystyrene and polyethylene terephthalate (better known as PET) continues to grow.
The EU plastics strategy of January 2018 says that the global primary production of plastics has increased twentyfold since the 1960s. This production currently amounts to more than 322 million tonnes, and according to estimates it could double once again over the next 20 years. But barely 30 per cent of all plastic waste is currently being recycled in Europe. One reason is that many plastics manufacturing companies are still unsure of the quality of recycled materials. On account of this and other factors, the call for a minimum proportion of recyclates in new products is growing louder.

**A turnaround for the material**

Manica Ulcnik-Krump is convinced that the necessary turnaround is possible – not just because countries such as Germany have a functioning collection system for lightweight packaging (particularly plastics), which ensures that the material flows are fully collected and disposed of in a regulated way. In addition, a lot has


Space for research and development: the future of plastics recycling is being shaped in Maribor, Slovenia.

happened since plastics started to be recycled, both in the circular economy and the manufacturing industry. ‘Ten years ago, people mixed waste plastics more or less randomly in Europe and were hardly able to influence the quality of the material. Today the situation is very different,’ Ulcnik-Krump says. The first milestone was the development of the Recycled-Resource process in 2009, in which Ulcnik-Krump played an essential role. Following this process, post-consumer plastics are first carefully sorted and cleaned. Then they are melted down and processed, aggregated, enriched with additives and chemically modified with the help of modern equipment. This highly complex process, which is called recompounding, makes it possible to tailor the regranulate to the customers’ needs.
One product from the Recycled-Resource process is the multi-award-winning regranulate known as Procyclen. This has the quality of new material and an impressive environmental footprint. Using Procyclen instead of new, petroleum-based material saves between 30 and 50 per cent of greenhouse gases. These figures alone cause Manica Ulcnik-Krump to be optimistic.

Even the colouring of the regranulate is put to the test.

**Always moving forward: Recycled-Resource**

The primary goal of the research and development work in Maribor is to further develop the state-of-the-art Recycled-Resource process. One important milestone was reached in 2016 when the team finally managed to integrate inorganic components such as glass fibre as fillers in the production process. This produced a highly stable Procyclen that could be used to manufacture foot pedals. Procyclen can now also be used in blow moulding for the production of laundry detergent bottles, for example. What’s more, depending on its area of application, the material can be created not only from polypropylene but also a variety of other types of used plastic, including high-density polyethylene or polystyrene.
To achieve the best results, the equipment is continually updated as well. At its production site in Eisenhüttenstadt, for instance, Interseroh recently began using a specially developed cascade extruder, which combines single- and twin-screw extrusion technology and has a worm shaft with a special geometry. This technology makes it possible to mix in a wider range of additives and homogenise the material even better. Manica Ulcnik-Krump and her team want to make these regranulates suitable for more new plastic products and industrial sectors. Because even though she enjoys receiving awards for the process – most recently the Slovenian Environmental Award 2017 – she prefers to hold the recycled products themselves in her hands. In her view they are the real reward for all of the invested time, energy and passion – and the sign of a sustainable future for plastics.

**resources SAVED: Around 3.4 million tonnes of primary resources were saved by ALBA Group in 2017 by recycling more than 900,000 tonnes of lightweight packaging* and plastics.**

**902,372 t**
**quantity recycled**

**PP 7,011 t (0.8 %)**
PE 117,387 t (13.0 %)
**PET 89,883 t (10.0 %)**
Mixed plastics 32,656 t (3.6 %)
**LWP ALBA 515,022 t (57.1 %)**
LWP Interseroh “Dual System” collections 140,413 t (15.6 %)

**3,406,988 t**
**Total resources saved**

**PP 24,749 t (0.7 %)**
PE 457,809 t (13.4 %)
**PET 222,910 t (6.5 %)**
Mixed plastics 108,418 t (3.2 %)
**LWP ALBA 1,802,577 t (52.9 %)**
LWP Interseroh “Dual System” collections 790,525 t (23.2 %)

*Calculations of resource savings are based solely on conventional collection using the German ‘Yellow Bin’/’Yellow Bag’ system.

# From steel giant **to cake server**

Like most metals, steel has a key advantage when it comes to recycling: the material can be repeatedly circulated in a closed loop with no loss of quality. And urban steel stock can be found almost everywhere: in bridges and cutlery, in cars and electric alarm clocks, in ships and jewellery. But the bigger the steel product, the more challenging it is to recycle – particularly as regards logistics. Decommissioned container straddle carriers are an imposing example of this.

ALBA Metall Nord GmbH housed ten massive straddle carriers for several weeks at its recycling yard in Wilhelmshaven. The company processes up to 10,000 tonnes of ferrous and non-ferrous metals per month at its site on the Jade Bight. Decommissioned container carriers from German seaports are a rare sight here – but a very impressive one. Each of the four-legged steel giants weighs around 70 tonnes, has a footprint the size of a lorry and towers around 15 metres high. Before arriving at the recycling yard to be dismantled, the carriers had spent 10 years heaving large containers on and off ships in three-shift operations.

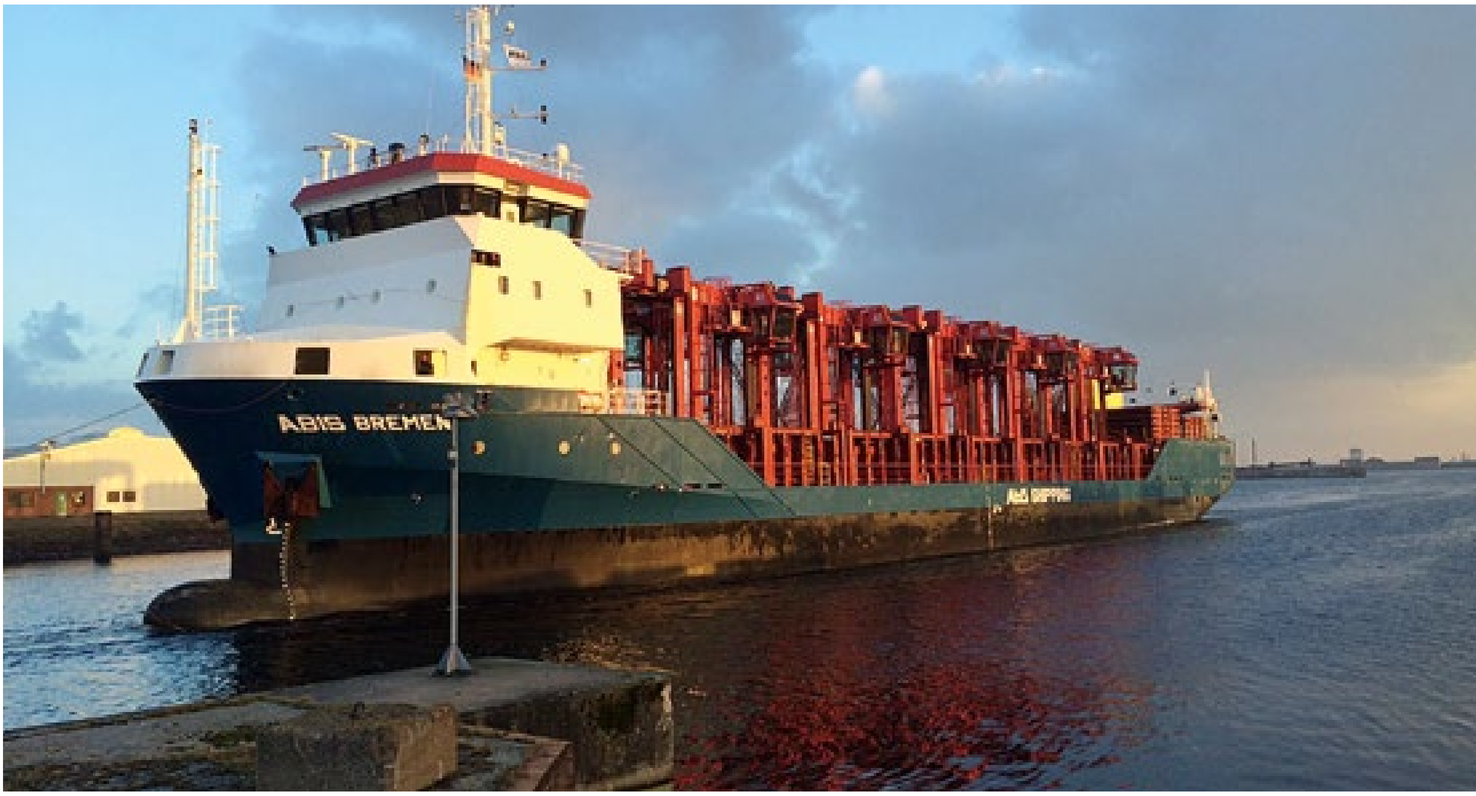
**Welding work 15 metres above ground**

Dismantling the old giants was a mammoth logistical task. The around 60,000 square metres of space at the scrap yard in Wilhelmshaven were already being used very efficiently, so the utmost precision was needed to unload the straddle carriers from the transport ship to the yard while leaving just enough space for the necessary demolition work.
Dismantling the carriers called for both a fine touch and a good head for heights. At a height of up to 15 metres, specialists in a cabin crane secured each of the major components with cables and then separated them using blowtorches before setting them carefully on the ground. That's when the detail work started. All of the big parts that were lowered by the crane were cut down piece by piece to steelworks size with a blowtorch.

**Versatile material**

Within just a few weeks, employees at the site had completely dismantled all ten straddle carriers. And the painstaking work paid off: in addition to hundreds of tonnes of high-quality steel scrap, they were able to recover tonnes of non-ferrous metals such as aluminium and copper, which had been integrated into the cables and circuit boards inside the carriers. After the full disassembly, the cut-down pieces of steel were finally transported to the steelworks that handle the 'reconditioning' of the material.
At the steelworks, steel scrap like that from Wilhelmshaven is always processed following the same principle. The material is heated to a high temperature, then rolled out into sheets and finally rolled up. Manufacturing companies such as automotive plants or toolmakers can use the sheet metal as a direct equivalent for new material in their production. This means that a

Components are cut to size with blowtorches and taken to the steelworks, where they are heated and rolled into sheets.




Impressive dimensions: each container straddle carrier is 15 metres high and weighs around 70 tonnes.

container straddle carrier that was dismantled just a few months ago might already be rolling down German streets in form of a new car – or sitting in a kitchen drawer with other cutlery.

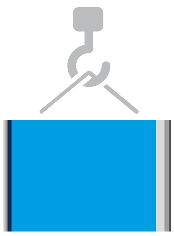
**Steel scrap is increasingly important**

Container straddle carriers are just one example of large machines that, on account of their high proportion of steel, are a desirable source of raw materials for the German steel industry. Steel scrap has long been the second most important material in the production of crude steel; nearly half of the crude steel in Germany is smelted from scrap material. Worldwide, too, steel is the material recycled most often. In the European Union, for example, the recycling rate for packaging made of steel amounted to around 79.5 per cent in 2016 – a new record. The reason for this rate is obvious: the closed-cycle management of this high-quality metal requires little effort, and it saves money, protects natural ore deposits and reduces the emission of greenhouse gases. The German steel industry alone uses more than 20 million tonnes of steel and iron scrap in its new production each year; this corresponds to the mass of around 3,000 Eiffel Towers. It is estimated that steel recycling in Germany prevents the emission of more than 20 million tonnes of $CO_2$ annually. Steel recycling is expected to become even more important in the future, because steel is on the advance around the world. Since 1970, global crude steel production has nearly tripled from 595 million tonnes to almost 1.7 billion tonnes per year. With an annual production of around 42 million tonnes, Germany ranks seventh in the world here. More than two out of every three tonnes of steel in Germany are used in construction, mechanical engineering and car manufacturing. Calculations show that the future demand for raw materials in the German steel industry cannot be covered by primary material alone. This means steel recycling will ultimately be a win-win business for the economy and environment alike.

**resources SAVED: Around 17 million tonnes of primary resources were saved by ALBA Group in 2017 by recycling more than 1.3 million tonnes of metals.**

**1,393,897 t**
**quantity recycled**

Aluminium 64,913 t (4.7 %)
Copper 13,958 t (1.0 %)
Steel 1,286,275 t (92.3 %)
Stainless steel 18,584 t (1.3 %)
Lead 3,642 t (0.3 %)
Zinc 2,167 t (0.2 %)
Brass 4,358 t (0.3 %)



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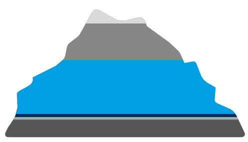


**16,970,326 t**
**Total resources saved**

Aluminium 1,231,400 t (7.3 %)
Copper 4,349,452 t (25.6 %)
Steel 9,827,141 t (57.9 %)
Stainless steel 650,456 t (3.8 %)
Lead 34,963 t (0.2 %)
Zinc 91,036 (0.5 %)
Brass 785,878 t (4.6 %)

# Diagnosis: **CFC**

From plastics to glass to precious metals – the waste electrical equipment material stream is more heterogeneous than almost any other. At the same time, short innovation cycles imply that the materials, composition and design of the equipment are constantly changing. The recycling process must be modified accordingly so that as many recyclables as possible can be recovered and pollutants can be disposed of safely. The ALBA Group shows how this can be done with its patented recycling process for refrigerators.

Pentane or CFC? The test result from the measuring robot determines the recycling unit to which the refrigerator is sent.

The equipment in the recycling hall in Eppingen looks futuristic. At long roller tables, employees of ALBA Electronics Recycling GmbH attach delicate devices and tubes, pull levers and operate control panels. The recycling of refrigerators – which takes place on a large scale here – is more like a production process than a typical waste management procedure. And, in fact, the company in Baden-Württemberg does produce something: high-quality recycled raw materials.

### The challenge of insulating foam

Refrigerators are an outstanding source of materials for closed-cycle management. They contain many easy-to-remove, homogeneous components such as vegetable drawers made of plastic, shelves made of glass and casings made of steel. The real disposal challenge, however, is the insulating foam encased in the appliances. Into the 1990s, the propellant used for the foam was the gas known as chlorofluorocarbon (CFC) – a hazardous substance that is very damaging to the environment and must be handled and disposed of properly. The use of CFC was banned in 1995, prompting manufacturers to switch to the less damaging but highly flammable propellant pentane. But because refrigerators have a long service life, appliances containing CFC still wind up in the recycling loop today. The proportion of discarded refrigerators with CFC is currently around 40 per cent.

### Using modern detection techniques

In many parts of Europe, refrigerators are recycled

using classic shredder technology in combination with a special exhaust system. This process makes it difficult to reliably separate the various hazardous substances, however. ALBA uses a different method in Eppingen: In order to recycle appliances containing pentane or CFC as completely as possible while conserving resources, the company has been using a detection and recycling technique since 2017 that is unique in Germany.
The technicians first remove the more easily separated parts of the refrigerators, such as the shelves and plastic trays, and they take the cooling circuits off the rear panels and siphon off the coolant with a special ferrule. Then the refrigerators are ready for CFC/pentane detection. This key task is carried out by a bright yellow robotic arm which waits to spring into action at the end of the around 40-metre-long recycling channel. On command, the arm extends and sticks its measuring probe in the housing of each refrigerator and in every door. The probe measures the escaping gas and sends the result to a computer. Depending on the result, the employees then guide the waste appliance through an airlock into one of two enclosed recycling units.

**100 refrigerators per hour**

In the unit for refrigerators containing CFC, the metal and plastic parts are first separated from the foam, shredded and sorted into containers. What's left behind is between 3 and 6 kg of polyurethane foam, which is crushed in a grinder, opening up the pores in the foam. The gas released this way is captured by special CFC filters, siphoned into containers and finally destroyed at high temperatures in a hazardous waste treatment facility.
Pentane is a less critical hazardous material, so it can be disposed of in a less resource-intensive way. Refrigerators containing insulating foam with pentane are therefore sent to a second recycling unit built specially for them. Here, too, after the refrigerator housing has been opened and the foam removed and crushed, a special device suctions the released gas through pipes into a thermal exhaust air treatment unit. Around 100 refrigerators an hour are safely recycled in this environmentally friendly way.

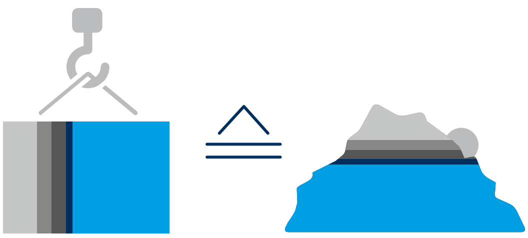
**Sustainable alternative: refurbishment**

The patented ALBA recycling plant in Eppingen is state of the art. But the employees are already preparing for the next generation of appliances. Refrigerators with an innovative vacuum insulation technology are already on the market. And when these are disposed of in the future, the electrical and electronic waste team will be ready to recycle them in the best way possible.
Disassembling and recycling used electrical appliances is just one way of managing products in a closed loop. More and more IT devices are being reconditioned instead for a second lease on life – following the motto of 'zero waste'. Interseroh handles IT refurbishment for company tablets and smartphones, laptops and electrical and electronic equipment, most of which are replaced in companies usually after only a short period of use. By reconditioning these devices that have been taken out of service, their useful life can be extended by many years – which is a great benefit to the environment. The Fraunhofer Institute UMSICHT has calculated that refurbishing a tablet even one time saves 58 kg of primary resources and reduces the emission of harmful greenhouse gases by 139 kg. Yet another step toward an integrated circular economy.

**resources SAVED: More than 1.8 million tonnes of primary resources were saved by ALBA Group in 2017 by recycling over 72,000 tonnes of waste electrical equipment.**

**72,882 t**
**quantity recycled**

Large electrical appliances 14,291 t (19.6 %)
Refrigeration equipment 10,470 t (14.4 %)
Display screens 5,636 t (7.7 %)
LCD monitors 589 t (0.8 %)
Small electrical appliances 41,896 t (57.5 %)



**1,815,812 t**
**Total resources saved**

Large electrical appliances 379,998 t (20.9 %)
Refrigeration equipment 191,496 t (10.5 %)
Display screens 82,624 t (4.6 %)
LCD monitors 6,202 t (0.3 %)
Small electrical appliances 1,155,492 t (63.6 %)

# Exemplary closed loop **for kraft paper**

The building sector is one of the most resource-intensive branches of the economy. More than 500 million tonnes of mineral raw materials alone are used on German building sites each year, along with many tonnes of insulating material, metals and packaging. The better the resulting waste can be separated, the better it can be managed in a closed loop. A good example of this is the system for taking back and recycling kraft paper sacks developed by REPASACK GmbH, which is unique in Europe.

Used as tear-resistant, standardised transport packaging for cement, kraft paper sacks are indispensable on building sites. But after being used, they usually wind up with the mixed waste in most countries. Not in Germany. REPASACK GmbH, which is part of Interseroh, established an innovative take-back and recycling system specially for this packaging waste in 1992. In a dry cleaning process, the paper sacks are homogeneously recycled so the paper industry can use the material again as a high-quality recycled raw material. This is how the system works: Participating companies in the construction sector, as well as the agricultural, food, animal feed and chemical industries, send their empty kraft paper sacks pressed into balls weighing 500 to 1,000 kg to the REPASACK recycling plant in Oberhausen. There the balls of paper sacks first undergo optical quality control and are rid of larger impurities. In the next step, the balls go to the recycling unit, where a single-shaft material shredder with 24 cutting tips digs into the paper and tears it to shreds. The palm-sized pieces of paper then fall onto a conveyor belt.

**Eliminating impurities**

Even though the sacks are delivered empty, some product residue may remain inside the balls, along with broken bits from wooden pallets, or stones and pieces of metal. The latter in particular can cause major damage to the machines. This is why they are separated out using the following system: A flip-flow screen first filters out the smaller residual materials up to 10 mm in size. Larger pieces are sent with the paper into a material separator, where stones and metal are left behind while a stream of air blows the paper through.
Other particulates are sieved out again, and the shredded paper – now free of impurities – falls into a shaft where it is finally pressed into balls once more. The facility in Oberhausen recycles an average of five tonnes of kraft paper sacks an hour. What remains is around 95 per cent pure paper – making the REPASACK plant the only one in Europe to process kraft paper sacks so homogeneously.
At this stage, only some plastic film can still be found

The REPASACK recycling plant produces a new, high-quality raw material for the paper industry.

among the processed kraft paper. But since this film – unlike the paper itself – does not dissolve when mixed with water, it is simply scooped off in the pulper in the paper factory. The recycling process for kraft paper sacks pays off because it produces a new raw material for the paper industry that can be repeatedly managed in a closed loop without much effort. The REPASACK system has attracted a lot of interest worldwide. Delegations from abroad regularly visit Oberhausen to learn about kraft paper recycling.

**Seeking sustainable solutions for Europe**

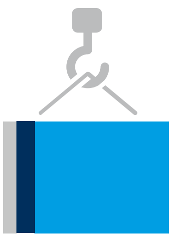
Kraft paper sacks are just one kind of packaging used on building sites. For other kinds, too – such as wood or glass – solutions for greater sustainability can be realised as long as there is close co-operation between the recycling and building industries. And such solutions will be even more important in the future, not only to strengthen the competitiveness of construction companies, but also to meet the requirements of the European Circular Economy Package. After three years of preparation, this set of directives was passed by the European Parliament in April 2018. Among other things, it encompasses the new Waste Framework Directive, the Landfill Directive and the Packaging Directive. The Circular Economy Package establishes new, binding, Europe-wide targets and deadlines for more recycling and the reduction of landfill use. From 2035, the maximum landfill rate for municipal solid waste should amount to just 10 per cent; in Germany, far less than 1 per cent of municipal solid waste has gone to landfills for many years. For packaging, there will be a recycling target of 70 per cent from 2030, though the targets for individual packaging types vary. For example, 75 per cent of glass packaging should be recycled in the future, while the recycling target for wood is 30 per cent. With their ideas for sustainability, companies in the circular economy can help create the conditions for more closed-cycle management and less waste – and they can improve the acceptance of recycled raw materials as an adequate replacement for primary materials in the long term.

Empty kraft paper sacks from building sites are recycled by REPASACK.

**resources SAVED – Wood, paper/paperboard/cardboard, glass: Around 4.4 million tonnes of primary resources were saved by ALBA Group in 2017 by recycling more than 1.5 million tonnes of wood, paper/paperboard/cardboard and glass.**

**1,589,599 t**
**quantity recycled**

**PPC 1,331,442 t (83.8 %)**
**Wood 128,900 t (8.1 %)**
**Glass 129,257 t (8.1 %)**



**4,375,520 t**
**Total resources saved**

**PPC 3,841,139 t (87.8 %)**
**Wood 268,112 t (6.1 %)**
**Glass 266,269 t (6.1 %)**

**Contact**

ALBA Group plc & Co. KG
Knesebeckstr. 56–58
10719 Berlin, Germany

INTERSEROH Dienstleistungs GmbH
Stollwerckstr. 9a
51149 Cologne, Germany

info@resources-saved.com
www.albagroup.de

Learn more about
resource conservation:
www.resources-saved.com

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